

7.1.13 25 kW Helium Refrigerator Scrub

1. Purpose

This procedure provides instructions for scrubbing the RHIC 25 kW helium refrigerator. The purpose of scrubbing is to remove contaminants such as air and water from the refrigerator prior to cooldown and operation of the refrigerator.

2. Responsibilities

- 2.1 The Shift Supervisor, or an Operator designated by the Shift Supervisor, is responsible for conducting the procedure and providing documentation in the Cryogenic Control Room Log and in the Cryogenic Valve Log.
- 2.2 Should a problem arise during the completion of this procedure, the Shift Supervisor shall contact the Technical Supervisor for instructions before continuing.

3. Prerequisites

- 3.1 Prior to scrubbing, the refrigerator must be pumped and purged.
- 3.2 The Operator shall be trained by the Shift Supervisor.
- 3.3 Operator shall be familiar with the following drawings:
 - Drawing 3A995009 25 KW Helium Refrigerator P & ID
 - Drawing 3A995032 HCS Block Diagram
 - Drawing 3A995078 RHIC Helium Gas Storage Refrigerator Valve Reference Guide
- 3.4 Operator shall be familiar with the physical location of components on the drawings listed under 3.2.
- 3.5 Purifier initialized per [C-A-OPM 7.1.28, "Compressor Room Cryogenic Purifier Operation"](#).
- 3.6 Operator shall be familiar with the control pages found on the CRISP control system.
- 3.7 Water cooling tower system operating.

4. **Precautions**

- 4.1 All personnel entering the compressor building (1005H) should wear hearing protection if compressors are operational for any reason.

5. **Procedure**

- _____ 1. Verify valve positions as specified in prerequisites [C-A-OPM-ATT 7.1.13.a.](#)
- _____ 2. On the CRISP compressor control page, set H3065A in automatic to control on PI3001 with a set point of 1.10 atmospheres.
- _____ 3. On the CRISP compressor control page, ensure valve H3025A is closed.
- _____ 4. On the CRISP compressor control page, ensure valve H3007A is closed.
- _____ 5. On the CRISP compressor control page, open H3019A manually to 50%.
- _____ 6. Set H3044A to maintain the suction pressure of the utility compressor at 1.05 atmospheres.
- _____ 7. Start the utility compressor.
- _____ 8. Set H3045A to maintain the discharge of the utility compressor at 15 atmospheres.
- _____ 9. Circulate helium in the refrigerator with the valve configuration specified in [C-A-OPM-ATT 7.1.13.a](#) while monitoring the gas purity levels to the inlet of the purifier. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
- _____ 10. OPEN the following valves:
H714A (at HX1B/2B)
H771A (at adsorber B)
H822M (at HX1B/2B)
- _____ 11. CLOSE the following valves:
H314A (at HX1A/2A)
H371A (at adsorber A)
H422M (at HX1A/2A)

- _____ 12. Circulate helium in the refrigerator with this valve configuration while monitoring the gas purity levels to the inlet of the purifier. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than – 60 C.

Caution:

Steps 13 –1 7 Concern scrubbing turbines 1A/2A and HX3A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 13. To scrub turbines 1A/2A, close the following valves:
H346M
H9168M
H9171M
- _____ 14. Open the following valves:
H407M
H266M
H9169M
- _____ 15. Regulate flow through the turbine string by adjusting pressure regulator PR9169M.
- _____ 16. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.
- _____ 17. Close the following valves:
H266M
H9169M
H9170M

Caution:

Steps 18-22 Concern scrubbing turbines 1B/2B and HX3B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 18. To scrub turbines 1B/2B, close valves H746M and H9168M.

- _____ 19. Open the following valves:
H703M
H9166M
- _____ 20. Regulate flow through the turbine string by adjusting pressure regulator PR9166M.
- _____ 21. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.
- _____ 22. Close the following valves:
H407M
H703M
H9166M

Caution:

Steps 23-26 Concern scrubbing turbines 3A/4A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 23. To scrub turbines 3A/4A, set the following valves:

| | |
|-------------|---------------|
| Open: H429M | Close: H6182M |
| H377M | H9177M |
| H9175M | |
- _____ 24. Regulate flow through the turbine string by adjusting pressure regulator PR9175M.
- _____ 25. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.
- _____ 26. Close the following valves:
H377M
H9175M

Caution:

Steps 27-30 Concern scrubbing turbines 3B/4B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 27. To scrub turbines 3B/4B, set the following valves:

| | |
|-------------|---------------|
| Open: H777M | Close: H6182M |
| H9172M | H9174M |

- _____ 28. Regulate flow through the turbine string by adjusting pressure regulator PR9172M.

- _____ 29. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than -60 C.

- _____ 30. Close the following valves:

H429M
H777M
H9172M

Caution:

Steps 31-34 Concern scrubbing turbine 5A/6A and HX7A. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 31. To scrub turbines set the following valves:

| | |
|-----------------------|---------------|
| Open: H431M | Close: H9184M |
| H393M | |
| H9182M | |
| H402A (turbine inlet) | |

- _____ 32. Regulate flow through the turbine string by adjusting pressure regulator PR9182M.

- _____ 33. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete

when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.

- _____ 34. Close the following valves:

H393M
H9182M
H402A

Caution:

Steps 35-38 Concern scrubbing turbine 5B/6B and HX7B. Prior to performing these steps, verify that turbine brakes have been applied. When introducing helium, do so gradually so as to not spin the turbines.

- _____ 35. To scrub turbines set the following valves:

Open: H793MM Close: H9180M
H9178M
H802A (turbine inlet)

- _____ 36. Regulate flow through the turbine string by adjusting pressure regulator PR9178M.

- _____ 37. Over the next 30 minutes monitor the gas purity levels at the inlet of the purifier for a rise. The gas purity levels can be monitored on page D11 of the CRISP control system. Scrubbing with this configuration is complete when the oxygen monitor shows less than 10 ppm and the hygrometer shows a dew point less than –60 C.

- _____ 38. Close the following valves:

H431M
H793M
H9178M
H802A

- _____ 39. Secure the utility compressor. Scrubbing is complete.

6. Documentation

- 6.1 The check-off lines on the procedure are for place-keeping only. The procedure is not to be initialed or signed, it is not a record.
- 6.2 The Shift Supervisor shall document the completion of the procedure in the Cryogenics Control Room Log.

7. References

- 7.1 Drawing 3A995009
- 7.2 Drawing 3A995032
- 7.3 Drawing 3A995078
- 7.4 Refrigerator Valve Reference Guide
- 7.5 [C-A-OPM-ATT 7.1.28 "Compressor Room Cryogenic Purifier Operation"](#).

8. Attachments

- 8.1 [C-A-OPM-ATT 7.1.13.a "Refrigerator Scrub Valve Lineup"](#).